

CLAIMS

What is claimed is:

1. A method for forming a patterned silicon-containing layer, comprising:

 providing a substrate;

 providing a polysilicon layer on said substrate;

 providing a hard mask layer on said polysilicon layer;

 patterning and etching said hard mask layer; and

 etching said polysilicon layer according to said hard mask layer using a fluorine-containing etchant gas.

2. The method of claim 1 further comprising providing an etchant gas devoid of fluorine and etching said polysilicon layer using said etchant gas devoid of fluorine.

3. The method of claim 1 wherein said etching said polysilicon layer comprises etching said polysilicon layer according to the following process parameters: a chamber pressure of from about 5 mTorr to about 80 mTorr; a source radio frequency power of from about 100 watts to about 1500 watts at a source radio frequency of 13.56 MHz; and a bias power of from about 100 watts to about 1500 watts.

4. The method of claim 3 further comprising providing an etchant gas devoid of fluorine and etching said polysilicon layer using said etchant gas devoid of fluorine.

5. The method of claim 1 wherein said polysilicon layer comprises pre-doped polysilicon.

6. The method of claim 1 wherein said polysilicon layer comprises amorphous silicon.

7. The method of claim 1 wherein said hard mask layer is a material selected from the group consisting of silicon oxide, silicon nitride and silicon oxynitride.

8. The method of claim 1 wherein said fluorine-containing etchant gas comprises a gas selected from the group consisting of fluorocarbon, fluoronitride and fluorosulfur.

9. A method for forming a patterned silicon-containing layer, comprising:

providing a substrate;

providing a polysilicon layer on said substrate;

providing a hard mask layer on said polysilicon layer;

patterning and etching said hard mask layer;

subjecting said polysilicon layer to a partial-etch step using a fluorine-containing etchant gas; and

subjecting said polysilicon layer to a complete-etch step using an etchant gas devoid of fluorine.

10. The method of claim 9 wherein said fluorine-containing etchant gas comprises a gas selected from the group consisting of fluorocarbon, fluoronitride and fluorosulfur.

11. The method of claim 9 wherein said etchant gas devoid of fluorine comprises chlorine, oxygen, helium and bromine.

12. The method of claim 9 wherein said polysilicon layer comprises pre-doped polysilicon.

13. The method of claim 9 wherein said polysilicon layer comprises amorphous silicon.

14. The method of claim 9 wherein said partial-etch step comprises the following process parameters: a chamber pressure of from about 5 mTorr to about 80 mTorr; a source radio frequency power of from about 100 watts to about 1500 watts at a source radio frequency of 13.56 MHz; and a bias power of from about 100 watts to about 1500 watts.

15. A method for forming a patterned silicon-containing layer, comprising:

 providing a substrate;
 providing a polysilicon layer on said substrate;
 providing a hard mask layer on said polysilicon layer;
 providing a bottom anti-reflective coating layer on said hard mask layer;
 providing a photoresist layer on said bottom anti-reflective coating layer;
 patterning and etching said hard mask layer;
 stripping said bottom anti-reflective coating layer and said photoresist layer from said hard mask layer; and
 etching said polysilicon layer according to said hard mask layer using a fluorine-containing etchant gas.

16. The method of claim 15 wherein said fluorine-containing etchant gas comprises a gas selected from the group consisting of fluorocarbon, fluoronitride and fluorosulfur.

17. The method of claim 15 further comprising providing an etchant gas devoid of fluorine and etching said polysilicon layer using said etchant gas devoid of fluorine.

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18. The method of claim 17 wherein said etchant gas devoid of fluorine comprises chlorine, oxygen, helium and bromine.

19. The method of claim 15 wherein said polysilicon layer comprises pre-doped polysilicon.

20. The method of claim 15 wherein said polysilicon layer comprises amorphous silicon.

21. The method of claim 1 wherein said polysilicon layer comprises a pre-doped polysilicon having a Dopant gradient.

22. The method of claim 9 wherein said polysilicon layer comprises pre-doped polysilicon having a Dopant gradient of high Dopant concentration in a top layer to a low Dopant concentration in a bottom layer of said polysilicon layer.